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Editorial: Mapping microbiology with scientometrics: help provide a clearer vision of microbiology research around the globe

Microbiology research covers a wide range of different disciplines, types of data, methods and applications, sometimes making it difficult to understand the "how and where" of the research field. Greater understanding of the current literature can help move us towards a more holistic view of microbiology, providing benefits to researchers, collaborators and learners alike.

Currently, the number of scientific articles in many research areas is increasing, creating a huge number of documents. This is a positive trend and is expected that the volume of articles will increase. This fact is true for the Microbiology research field, an incredibly diverse discipline, often at the forefront of many global challenges. Alongside the 'pure microbiology' fields (e.g. bacteriology, mycology, virology, phycology etc), microbiology techniques and understanding aid the advancement of the wider biological sciences (e.g. molecular biology, cellular physiology and genetics). Therefore, it is no surprise that publication of microbiology research is varied and wide-reaching with 124 journals indexed in Journal Citation Report 2016 and 136 microbiology journals indexed in Scimago Journal and Country Rank. Searching by the term "microbiology", more than 30,000 and 500,000 documents are retrieved in Web of Science and Scopus respectively (data took on January 2018).

Whilst reading a journal article is the standard way to keep up-to-date with a scientific field, there may be questions related to the 'who, where and how' of microbiology research, which are important considerations when attempting to understand the microbiology community, help build networks and highlight important issues/priorities for microbiology researchers. Thus, to take advantage of such large amounts of information (i.e. scientific articles) and turn it into

knowledge, there is a need for special techniques and tools. Bibliometrics is an academic science whose aim is to evaluate the research developed by any scientific community in any field through the scientific publications indexed in large bibliographic databases. Thus, Bibliometrics contributes to the progress of science allowing to discover information in different ways: assessing progress to be made, identifying the most reliable sources of scientific publication, laying the academic foundation of new scientific developments, identifying major scientific actors, developing bibliometric indices to assess academic output, and so on (Martínez *et al.*, 2014).

Bibliometrics is mainly devoted to measure the scientific production and quantify its quality and scientific impact. In addition, it is also focused on the understanding of the social, intellectual and conceptual structure through bibliographic networks (Cobo *et al.*, 2011; Batagelj and Cerinšek, 2013). On the one hand, the production and quality could be measured by means of bibliometric indicators (Hirsch, 2005; Egghe, 2006; Alonso *et al.*, 2009). Moreover, performing a citation classics analysis (Garfield, 1977; Martínez *et al.*, 2014), those papers with highest citation rate could be addressed. On the other hand, bibliographic networks (e.g. co-words, co-citation or co-authors, among others) could be analyzed by means of science mapping analysis (Börner, Chen and Boyack, 2003; Cobo *et al.*, 2011).

As a consequence, in this thematic series we encourage researchers to utilize data on research outputs such as journal articles, to help explain and understand the complexities of the microbiology community by means of a different bibliometric analysis. Therefore, it is launched with three existing articles. Nai (2017) provides a snapshot of microbiology research in South America based on bibliometric data, providing an intriguing view on the productivity rate (measured by number of publications) vs population size or number of research institutes. Rodrigues, Nimrichter et al. (2016) explore the benefit to scientific mobility and international

collaboration on the microbiology community. Whilst Redfern and Verran (2015) explore ‘what is a microbiologist?’, helping debunk the myth that the ‘microbiologist’ is disappearing profession, and instead highlight the cross-cutting, multidisciplined and essential role microbiology has within scientific endeavor.

As the mapping microbiology theme grows, we hope to share a diverse array of articles interrogating the metrics behind microbiology, as well as further information on the methodologies of scientometric data analysis. The following is a list of research questions that fit within the remit (but are not exhaustive):

- What microbiology research themes are most prevalent in Europe? Is there a difference in research focus between different geographic regions? What does the distribution of research look like for one particular sub-field? By means of a conceptual analysis, the different topics covered by a research field could be addressed. In that sense, it could describe the global evolution of a research field, or how different regions develop their research.
- How much microbiology research is published in non-microbiology journals? Microbiology is not just published in the core journals. Some research is multidisciplinary, and therefore is published ina range of journals. Analyzing this relationship could help detect what is happening outside the core research field, and also, what is the contribution of the microbiology to the whole knowledge.
- Does gender and/or career level have an impact on research outputs? The research career of male and female researchers at different levels could be variable due to many aspects. Analyzing the research output by gender or career level could highlight the problems that concern researchers, the differences in their research, their strengths and weakness, in order to provide better understanding and method to evaluate and promote researcher

independently of the career level and gender.

- What role does language play in the distribution of microbiology research? In an international context, English is assumed as the vehicular language. However, for non-native English speakers, writing an article in a language different of their mother-tongue could be a daunting task. Analyzing the internationality of the research, and also paying attention to the research conducted in non-English countries could address new insight of the structure of the field.

We are happy to hear from researchers of any discipline who have ideas and data which may help further understand the field of microbiology. All submitted papers will be subjected to our standard independent peer-review. For more information and guidance on submission please visit https://academic.oup.com/femsle/pages/scientometrics_mapping_microbiology.

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